

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 20 DEC 2005

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Applicant's or agent's file reference PI8463WO1	FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No. PCT/SE2003/001368	International filing date (day/month/year) 03-09-2003	Priority date (day/month/year)
International Patent Classification (IPC) or national classification and IPC See Supplemental Box		
Applicant Telefonaktiebolaget LM Ericsson (publ) et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 7 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
 - a. ☒ (sent to the applicant and to the International Bureau) a total of 3 sheets, as follows:
 - ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
 - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
 - b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

- | | | |
|-------------------------------------|--------------|---|
| <input checked="" type="checkbox"/> | Box No. I | Basis of the report |
| <input type="checkbox"/> | Box No. II | Priority |
| <input type="checkbox"/> | Box No. III | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| <input type="checkbox"/> | Box No. IV | Lack of unity of invention |
| <input checked="" type="checkbox"/> | Box No. V | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| <input type="checkbox"/> | Box No. VI | Certain documents cited |
| <input type="checkbox"/> | Box No. VII | Certain defects in the international application |
| <input checked="" type="checkbox"/> | Box No. VIII | Certain observations on the international application |

Date of submission of the demand 22-02-2005	Date of completion of this report 25-11-2005
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. +46 8 667 72 88 Form PCT/IPEA/409 (cover sheet) (April 2005)	Authorized officer Ender Dag /LR Telephone No. +46 8 782 25 00

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/SE2003/001368

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of: **Cover sheet**

H04Q 7/38 (2006.01)

G01S 5/14 (2006.01)

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

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Box No. I Basis of the report

1. With regard to the language, this report is based on:

- ☒ the international application in the language in which it was filed
☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of:
☐ international search (Rules 12.3(a) and 23.1(b))
☐ publication of the international application (Rule 12.4(a))
☐ international preliminary examination (Rules 55.2(a) and/or 55.3(a))

2. With regard to the elements of the international application, this report is based on (replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):

- ☐ the international application as originally filed/furnished
☒ the description: _____ as originally filed/furnished
pages 1-8
pages* _____ received by this Authority on _____
pages* _____ received by this Authority on _____
☒ the claims: _____ as originally filed/furnished
pages _____ as amended (together with any statement) under Article 19
pages* _____ received by this Authority on 2005-08-24
pages* 9-11 received by this Authority on _____
☒ the drawings: _____ as originally filed/furnished
pages 1-4
pages* _____ received by this Authority on _____
pages* _____ received by this Authority on _____
☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
☐ the claims, Nos. _____
☐ the drawings, sheets/figs _____
☐ the sequence listing (specify): _____
☐ any table(s) related to the sequence listing (specify): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages _____
☐ the claims, Nos. _____
☐ the drawings, sheets/figs _____
☐ the sequence listing (specify): _____
☐ any table(s) related to the sequence listing (specify): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/SE2003/001368

Box No. V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)

Claims

1-18

Claims

YES

NO

Inventive step (IS)

Claims

1-18

Claims

YES

NO

Industrial applicability (IA)

Claims

1-18

Claims

YES

NO

2. Citations and explanations (Rule 70.7)

Documents cited in the International Search Report:

- D1: US 2003139188 A1
- D2: US 6195556 B1
- D3: US 6282427 B1
- D4: US 2002132623 A1
- D5: US 6501955 B1
- D6: US 6122512 A

The applicant describes the problem of positioning mobile station in relation to a base station in a cell. Prior art discloses methods with need of several base stations involved for locating the position of a mobile station in the same cell. The object of the present application is to determine the mobile station bearing from received signal level and signal level received in a co-sited neighbour cell.

Document D1 discloses a system for locating mobile stations (22) using timing advance value associated with the mobile station. An identification area is selected smaller than the cells and sectors in which mobile stations may be located, and signal strength measurements are used to specify a location within the selected area. The signal strength measurements of signals are associated with same cell neighbouring sectors or different cell neighbouring sectors. To account for propagation delay a timing advance value (TA) is assigned to mobile station so that the signal arrives at a base station (20) in the expected time (see page 2, [0024]-[0025], page 3, [0029]-[0030]; figures 2, 3, 5).

.../...

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of: BOX V)

Document D2 discloses a system and method utilizing multiple narrow beams in conjunction with signal strength and/or time difference of arrival information to determine the location of a mobile communication unit.

Document D3 discloses a location measurement unit for measuring an uplink signal received from a mobile communication station operating in a wireless communication network in order to locate the position of the mobile communication.

Document D4 discloses a system and method for determining the location of a mobile station within a wireless network when only two base stations are available for time of arrival or other triangulation measurements.

Document D5 discloses a radio frequency repeater provided for repeating signals transmitted between a mobile unit and a base station. The radio frequency signal repeater tags the repeated signal with an electronic signature so that signals passing between the mobile unit and the base station and through the radio frequency signal repeater may be identified.

Document D6 discloses a system and method for continuously evaluating the distance between a mobile station and a radio base station from a propagation delay. The propagation delay is determined according to the present method when the mobile station sends access bursts to the base station, which measures the access delay of the arrived bursts in the same way as an ordinary handover.

D1 represents the closest prior art document. The claimed invention according to claims 1-18 differs from what is known in D1 in that determining at a base station site of known position the position of a mobile station without pre-recorded position map. This is achieved by forming a linear scale ratio or dB-scale difference for estimating direction and estimating distance from propagation delay time. This improves the accuracy positioning by distinguish different directions within a sector.

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International application No.

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Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of: BOX V

The problem to be solved is to accuracy determined direction and distance of received propagation delay time. D2-D6 shows requirement of communication involving more than one site of sector for positioning. None of the indicated documents refer linking elements for positioning based on distinguishes knowledge of direction of received signal.

The problem to be solved in D2-D6 does not address the same problem to be solved in the claimed invention. D2-D6 describes positioning methods requiring communication involving more than one site for, e.g. triangulation. However, D2-D6 does not distinguishably determine positioning of received signals within a sector.

Hence it is not obvious for a person skilled in the art to modify D1 with help from D2-D6 to solve the same problem as referred to in the claimed invention.

The invention according to claims 1-18 is novel, industrial applicable and is considered to involve an inventive step.

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

The matter for which the invention is sought shall be clear and concise in the term of technical features of the invention.

The protection for the matter of the invention must be indicating the statement for the technical features of the sought invention. Present dependent claim 2 is defined with additional technical features as duplication and an alternative way of the same statement of technical features of the invention in claim 1. Compare the expressions: "(claim 1) transmitter is camping or being served and signal level in one or more co-sited cells/sectors different from the cell/sector where the transmitter is camping or being served..." respectively "(claim 2) at least one of the one or more co-sited cells/sectors is immediate neighbour of the cell where the transmitter is camping...". The interpretation of the embodiment in claim 2 is a duplicate statement of a partly defined embodiment in claim 1 only the difference is done with two different way of expressing same technical feature. Consequently, claim 2 shall be eliminated or cover the distinctive additional technical feature that is not a duplicate of the matter of referred previous claim.

The interpretation of the claim 18 is referred to "any of claims 9-16...". Therefore, the reference for which dependent claim it is referred to should be changed to this.

CLAIMS

1. A method of positioning a radio transmitter characterized in that distance to a receiver of known position is determined according to a parameter reflecting propagation delay time and that direction from the receiver to the transmitter is determined from a respective parameter reflecting received signal level in a cell/sector where the transmitter is camping or being served and signal level in one or more co-sited cells/sectors different from the cell/sector where the transmitter is camping or being served, wherein direction to the transmitter is determined by forming a respective linear scale ratio of or dB-scale differences between at least one or more neighbor cell/sector received level and received level of the cell/sector where the transmitter is camping or being served, the received levels being related to the same site.
2. The method according to claim 1 characterized in that at least one of the one or more co-sited cells/sectors is immediate neighbor of the cell where the transmitter is camping or being served.
3. The method according to claim 1 characterized in that determination of transmitter positioning includes cell/sector identity.
4. The method according to claim 1 characterized in that the received signal level is averaged prior to forming a basis for positioning.
5. The method according to claim 4 characterized in that the average is formed in a network control element.
6. The method according to claim 5 characterized in that the network control element is an entity

most closely connected to the receiver entity over a standardized interface.

7. The method according to claim 6 characterized in that the entity most closely connected to the receiver is a base station controller.

8. The method according to claim 6 characterized in that the entity most closely connected to the receiver is a radio network controller.

9. A device of positioning a radio transmitter characterized by processing means for determining distance to a receiver of known position according to a parameter reflecting propagation delay time and direction from the receiver to the transmitter from a respective parameter reflecting received signal level in a cell/sector where the transmitter is camping or being served and signal level in one or more co-sited cells/sectors, wherein direction to the transmitter is determined by forming a respective ratio of the neighbor cell/sector received level and received level of cell/sector where the transmitter is camping or being served, the received levels being related to the same site.

10. The device according to claim 9 characterized in that the co-sited cell/sector is at least one of the cells/sectors being immediate neighbors of the cell where the transmitter is camping or being served.

11. The device according to claim 9 characterized by the processing means including cell/sector identity determination of transmitter positioning.

12. The device according to claim 9 characterized by the processing means forming a time average

of received signal level prior to forming a basis for positioning.

13. The device according to claim 12 characterized in that the average is formed in a network control element.

14. The device according to claim 13 characterized in that the network control element is an entity most closely connected to the receiver entity over a standardized interface.

15. The device according to claim 14 characterized in that the entity most closely connected to the receiver is a base station controller.

16. The device according to claim 14 characterized in that the entity most closely connected to the receiver is a radio network controller.

17. Radio communication system characterized by means for carrying out the method in any of claims 1-8.

18. Radio communication system characterized by a plurality of devices in any of claims 9-18.